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ABSTRACT

Current approaches to distance education in elementary and secondary schools are summarized in this review of the literature, which was conducted to identify distance education programs at the K-12 level, together with any associated evaluation or research findings, and discover implications of these findings for future developments in this area. The literature was identified through a search of the ERIC database using the descriptors Distance Education, Telecommunications, Teleconferencing, and Communication Satellites combined with the descriptor Schools. Five research reviews and nine primary research studies were selected from the 42 relevant documents retrieved, and these 14 studies were examined in relation to three research questions: (1) the types of media used in public school (K-12) distance education; (2) the focus of instruction in public school distance education, i.e., who is served and the content and instructional design that are used; and (3) the judgments that are being made about the effectiveness of distance education at the K-12 level. It was concluded that more evaluations of the effectiveness of distance education via electronic media are needed, and that a set of criteria needs to be established for both formative and summative evaluations to obtain meaningful data. A summary table is appended which provides information on each of the 14 studies analyzed, including the citation for the study, the population served, technology used and subject areas involved, conclusions reached, and implications of the findings. (EW)

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STATEWIDE EVALUATION REPORT ON PRODUCTIVITY PROJECT STUDIES RELATED TO IMPROVED USE OF TECHNOLOGY TO EXTEND EDUCATIONAL PROGRAMS

Sub-Report Two: Distance Education in Elementary and Secondary Schools: A Review of Literature

Submitted to the

Education Planning and Development Section of the Utah State Office of Education

Submitted by the

Wasatch Institute of Research and Evaluation

Prepared by

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Introduction

In this report the findings from a literature review which explored current approaches to distance education in elementary and secondary schools are summarized. Originally, we had planned to review the literature on technology as it is used to extend educational programs more generally. However, that literature is immense and the majority of the projects in Utah involve technology applied to distance education; so we took a narrower focus to learn what was being discovered in the literature on distance education programs.

The objective of the study was to identify distance education programs in elementary and secondary schools and associated evaluation or research findings to discover implications of these findings for future developments in distance education. However, because much of the research on distance education has been at higher education levels, some of that literature is reviewed too.

The report is organized thus: First, the origins of distance education are discussed to place this inquiry into the current approaches to distance education in elementary and secondary schools in a larger context. Second, evaluation and research findings in k-12 settings are presented in response to three main research questions. Third, implications for future inquiries are discussed.

Origins of Distance Education

To set the scene for the discussion of public school school applications of technology to distance learning, a brief history of the evolution of the concept (mainly in higher education) is presented. Several characteristics of distance education, the media or technologies that are used, and characteristics of the students involved are summarized too.

History

Distance education (or indirect education, as it is sometimes called), meaning the absence of conventional face-to-face communication in education, has taken a variety of forms over many years. Education by letter was used by Plato, Paul and Erasmus for educational purposes and is a practice which, however informally or formally, continues today. Printed

media, teaching kits, audio-visual aids, radio and television, programmed learning and, more recently, computer-aided learning are also forms of distance or indirect education used today, along with which varying degrees of face-to-face communication between teachers and students are sometimes incorporated (Keegan, 1986). Each of these forms of indirect education is used to transmit knowledge from one source to another in circumstances where special needs are apparent or where conventional resources are lacking.

In 1969 the British Open University was established to address the educational needs of students who could not be reached by conventional means. It was a radical innovation in teaching based on a combination of broadcasting (television and radio) and specially written texts. The Open University was technologically based, although broadcasted lessons contributed no more than 10% of a student's study time. Rather, correspondence texts supported by part-time counselors and tutors were the dominant forms of media used (Perry, 1974). "Open education" (see Keegan, 1986, p.23) has taken on a number of different connotations over the past several decades, although, in this context it suggests instruction by means of didactic media without the necessity of regular class participation. While this general notion of the open university concept is fairly consistent across settings, the concept should not be restricted to the specific characteristics of the British Open University.

In his book, The Foundations of Distance Education (1986), Keegan notes that distance education has been classified in a number of ways according to a variety of different characteristics. Because distance education has been characterized in so many diverse ways, global or general statements about distance education are rarely valid. He advocates that a stringent set of characteristics be defined which should not only create a classification of distance education programs, but should be broad enough that many programs which would be included in other more narrow typologies would not be excluded.

Keegan, as well as several others, have suggested that distance education programs can be classified according to two variations on the open univeristy concept (Bates, 1984; Kaye and Rumble, 1981). First, there are those distance education programs which are autonomous

correspondence schools and open universities primarily dedicated to distance education (e.g., the Teleuniversite in Quebec, Athabasca University in Alberta, Open Learning Institute in Vancouver, Open University of Sri Lanka, Allama Iqbal Open University of Pakistan in Asia, Fernuniversitat of West Germany, UNED of Spain, Everyman's University of Israel in Europe, UNED of Costa Rica and UNA of Venezuela). The characteristics of autonomous programs may also vary. Some programs offer courses below a university level (usually correspondence schools for either adults or children) and tend to have very little face-to-face or other support services available. Other programs offer university level courses and provide a variety of support services.

Second, distance education services are offered by many conventional institutions in a number of countries. Distance education programs of the second type may also vary. Some are conventional independent study programs and/or extension colleges. Others follow a consultation model where a combination of face-to-face and homestudy learning takes place.

With such diverse practices, all of which are considered distance education, Keegan's concern for formulating a stringent typology of distance education is understandable. However, creating a set of broad categories under which all types of programs might fall is not necessarily the only or best way to obtain more valid conclusions about distance education. Rather, distance education can be examined according to a number of specific characteristics (those which are usually subsumed under Keegan's broad classification). It is possible that by identifying and focusing on more specific characteristics of distance education, more specific conclusions can be drawn. And, in any attempt to understand the field of distance education, it is important to note these definitional characteristics of distance education which are commonly used.

Characteristics of Distance Education

Keegan, in fact, carefully examined numerous definitions of distance education in the process of creating his typology. From his summary of these definitions as well as Holmberg's discussion of definitional characteristics, several commonly used characteristics emerge: 1)

Distance education is often defined as being based on non-contiguous communication where the student and the instructor are separated throughout the duration of the learning process; 2) Commonly, the instruction includes the use of pre-produced, self-instruction oriented materials; 3) Often technological media such as audio, video, telephone or computer are used to unite the student and the instructor; 4) Some form of two-way communication between the student and instructor is usually provided in order for the student to benefit from dialogue with the instructor; 5) This interaction is generally organized around assignments students submit; 6) Dialogue between the instructors and student is especially important because students are most often taught individually. Nevertheless, there may be an occasional possibility of meetings with peer students. (Holmberg, 1981).

Distance education is primarily used in professional programs in order that individuals be advanced educationally and socially in circumstances where resources are often lacking (Holmberg, 1977). However, as Holmberg notes, a number of intrinsic characteristics of distance education make it a desirable alternative for societies not necessarily lacking in educational resources: 1) Distance education can be used with large groups of students in a form of mass communication; it is particularly attractive when educational institutions are overburdened; 2) The quality of instruction can increase by assigning the best subject specialists and educationists available to produce courses for large groups of students; 3) Users claim the methods effectively help students acquire knowledge and skills (although little evidence of this claim is given); 4) It is economical because of the large-group approach and the elimination (or diminuation) of residential teaching; 5) Study pace and (to some extent) study content can be easily individualized; and 6) It encourages student's to work on their own and to develop independence leading to greater autonomy than do other types of study (Holmberg, 1977, p. 18). Thus, not only has distance education been used to address the lack of conventional resources, it has been viewed advantageously as an instructional option in certain circumstances.

Which Media Are Used?

From Keegan's (1986) studies of practice in the 1980's, he concluded that the British Open University was unique from other open universities because of its emphasis on broadcast television as a medium for distance education. Yet, even the British Open University's use of broadcast media was minimal. He reported that the British Open University of the early 1980's (before severe budget cuts) used approximately "80% correspondence, print-based materials, 10% face-to-face sessions, 7% broadcast television, [and] 3% broadcast radio (Keegan, 1986, p. 185)." Nevertheless, Bates (1984) reported that the British Open University is experimenting the most with new technologies in distance education.

Simply because electronic media are not predominent in distance education does not suggest that they have been conclusively found to be ineffective. Sewart, Keegan and Holmberg (1983), identified current uses of print-based, audio-based, video-based, and computer-based media in distance education, suggesting that while print-based instruction is most commonly used, audio-based instruction has often been found cost-effective and specifically appropriate where literacy is a problem. Likewise video-based and computer-based instruction have hopeful futures as home VCR's and personal computers are becoming more available. Bates found three interesting trends relevant to the use of audio-visual media in distance education: 1) "There is a clear movement away from using broadcasting by distance learning systems; 2) The range of audio-visual media suitable for distance education is rapidly increasing; [and] 3) The educational potential of audio-visual media still tends to be under-exploited by distance education systems (Sewart, Keegan, & Holmberg, 1983, p. 227). Thus, it is apparent that while technological media may be used less, recent advances in the field regarding availability and capability make the choice of media (specifically, electronic media) still a critical area for future inquiry.

Bates (1983, p. 238) identified five points to consider when choosing media for distance education. First, are the media **accessible** to most students' homes? Second, is the medium **convenient** for the students to use? Third, does the teacher involved have **control**

over the instructional content? Fourth, do the media allow for a **human touch** to be included? Fifth, are the media **available** to use? While these guidelines may be initially helpful in choosing media, there is little evidence of how the use of such guidelines has resulted or can result in better application of different combinations of media to meet different types of students' needs, with different content in different instructional settings involving distance education.

Characteristics of Students Receiving Distance Education

It is difficult to obtain a concise description of students who participate in distance education because they come from a diverse population in several different countries, differing in economic status and social/cultural values. Kaye and Rumble (1981, p. 35) have, however, identified several characteristics which tend to be common across the population of distance education students:

> 1) Their *age range* tends to be between 20 and 40 years - unlike the case in most post-secondary institutions...
> 2) Most students are studying on a *part-time basis* ...
> 3) In many cases, *men* make up by far the highest proportion of the student body...
> 4) Distance-learning students study primarily at home with all the competing demands on their time and attention that home life provides...
> 5) *High levels of motivation* are the general rule amongst distance students...
> 6) Correspondence students tend *not* to come from wealthier, privileged strata of society...
> 7) Concerning geographical distribution,one can identify two opposing tendencies; a widespread distribution on, for example, in-service courses where the target population is by definition dispersed (e g. schoolteachers), but a tendency for urban concentration on many other self-selected courses...
> 8) In general, distance-learning projects tend to cater for more heterogeneous groups of students than do conventional post-secondary institutions...

Keegan (1986) concluded that there are four major ways in which distance education students are different from conventional students. First, distance education students tend to be older and come to the educational experience with more work, family and community experience. Second, while conventional students usually have education as a first priority in the hopes of obtaining employment some day in the future, distance education students are usually

employed already. Career and family are their first priority. Third, fewer educational support services such as libraries, laboratories and other facilities are available to distance education students compared with the academic environment of conventional students. Fourth, conventional students tend to view their education as a "sure route to a pleasant and comfortable future job" while the distance education students view their education as extra work and an additional investment in a lifestyle which is already full of reponsibilities (Keegan, 1986, p. 171).

Distance Education in Elementary and Secondary Schools

Narrowing the Focus

In light of the information gleaned from the review of the origins of distance education, it seemed ideal to review all literature pertaining to the field of distance education, with applications at all educational levels. Consequently, an initial ERIC search was conducted. The descriptor, *distance education* , which means, "education via the communication media (correspondence, radio, television, and others) with little or no classroom or other face-to-face delivery," was used to yield 446 documents. However, because the resources required to conduct a review of such a large body of literature went beyond what was available for this review, it was determined to narrow the focus of this review to a meaningful subset of the distance education literature. In order to select such a subset, a scanning process was used with these initial 446 documents. The results of the scan of titles and abstracts of these documents indicated that a good deal of this literature pertained to higher education applications.

For example, one typical document included in this large body of literature is an extensive document reporting on the planning and implementation of a multimedia college program in Nebraska (State University of Nebraska, 1985). In this document, results of initial evaluation activities as well as course outlines and descriptions of students are included. Further, a section of this document is devoted to stating a position on a proposed model for evaluating learning obtained via this distance education program.

Similarly, in another such document the Rio Salado Community College in Arizona reported on the use of the SUNDAIL network for GED preparation. By means of an audio teleconferencing system, GED instruction was delivered to adult students in Arizona. In this document, information is given regarding the types of students included in the project, details on the implementation of the program and the types of material covered in the course which were developed. These two documents are indicative of a number of other documents which focus on the implementation of specific distance education programs in higher education.

Not only is the larger body of literature made up of many higher distance education program descriptions, some with evaluation results, there are a number of articles which focus more broadly on problems confronted in higher distance education. For example, Stubbs (1985) reported on the problems confronted by universities that provide both conventional on-campus services as well as distance education programs. Stubbs reported that distance education programs, because they often develop informally, never become well focused educational efforts. Even though distance education students often generate substantial income for the institution, because of their low profiles on campus, they often received "second-class" status by the administration and faculty. In fact, distance education students, whose main link to the institution is usually an under-trained teaching assistant are frequently perceived as having the same educational needs as on-campus students; something which is often not the case. While the focus of the program discussed by Stubbs is mainly involved with distance education using print media, documents such as this do constitute are good portion of the literature in this pool of 446 documents.

Even though print media does dominate much of the literature on higher distance education, there is an indication that some authors have attempted to focus more on the implementation of electronic media in higher distance education. One such effort, was made by Bunson (1985) who conducted a survey of telecommunications in higher education. In this report, several interactive and noninteractive video programs used in higher education are described.

Although most of the 446 documents focus on higher education applications with little if any reference to the use of distance education in elementary or secondary schools, the scanning process identified a few such applications. While it is possible that some of what is being learned about the implementation of various components of distance education technology in higher education is relevant to its use in public schools (K-12), there is no evidence of any empirically founded comparisons. However, before a comparison can be made, what is currently known about distance education at the elementary and secondary levels must be identified.

In this section specific questions pertaining to the use of distance education in elementary and secondary schools which were addressed by this review are identified, the methods used in addressing these questions are described, and responses to the questions based on the extant literature are presented.

Questions

Rural school districts often have a small student population and few teachers. Under such conditions, one teacher at the secondary level often teaches several preparations; sometimes teaching across a number of subject matter disciplines. Even with the tremendous efforts of such teachers, it is usually difficult, if not impossible, to offer classes which are important to a student's chances at university entrance and success at each secondary school in the district. Chemistry, physics, foreign languages, advanced math classes, and advanced placement classes are all difficult to offer with the existing teacher corps in many districts.

Consequently, the use of computers and computer networks, satellites, two-way video as well as other media and combinations of media are being introduced into classrooms which have had little previous orientation to modern technology. The advent of distance education and its initial attempts to address rural education problems, such as those briefly mentioned above, raises three major questions which this literature review and the larger study of which it is part addressed:

1. What types of media are used in public school (K-12) distance education?

2. What is the focus of instruction in public school distance education? (Who is served? What content and instructional design are used?)

3. What judgements are being made about the effectiveness of distance education at elementary and secondary levels?

Methods

A literature review was made of published and unpublished documents on the effectiveness of instructional technology to enhance and extend educational programs through distance education. Two methods for conducting this literature review were used. First a computer and manual search of literature was conducted including a search of the computerized data base, ERIC. Second, the ancestral or branching bibliography approach was used to check references from each of the articles obtained by the other methods.

The Computer Search. In order to conduct the computer search, descriptors were identified which would pertain most directly to distance education. In addition to the *distance education* descriptor previously mentic ed, the following were identified as descriptors for the ERIC search.

1. School, defined by ERIC as "educational institutions at all levels..."
2. Teleconferencing, defined by ERIC as "conducting conferences between persons remote from one another by means of a telecommunication system."
3. Telecommunciations, defined by ERIC as "long distance communication using electromagnetic systems" such as radio, television or satellites.
4. Communication Satellites, (no definition is given by ERIC).

The initial computer search, using *distance education* as the major descriptor yielded 446 documents. Three months later another computer search which was conducted, again using only the *distance education* descriptor, yielded 503 documents (this suggests that the body of literature on distance education is growing rapidly and that additional reviews might be in order).

The set of 503 documents included any literature pertaining to distance education efforts in elementary, secondary and higher education as well as education in industrial settings. It would have been ideal to manually review each of these 503 articles to determine to what degree, if at all, they pertained to elementary and secondary applications. This, however, was not possible given the available resources. Consequently, the document coding system used by ERIC was used to further limit the body of literature. Because the focus of this study was on the use of distance education in schools, *schools* was used as another descriptor. The combination of *distance education* and *schools* yielded 46 documents.

Relevant literature pertaining to the use of teleconferencing, telecommunication systems and communication satellites in schools were not always included under the *distance education* descriptor. Consequently, *telecommunication* , *teleconferencing* and *communcation satellites* were combined with *schools* and yielded 29 documents.

After eliminating documents included in the 29 documents which had also been identified in the previous 46, a total of 62 documents remained from the two combinations of descripters. Of these 62 documents, 20 were related only to higher education. Once these were manually excluded, 42 documents remained. This body of literature yielded a fairly narrow scope of documents relating to the use of distance education and technologies in schools which could be reviewed to satisfactorily begin to answer the major inquiry questions.

Ancestral Approach. Once these documents were collected, additional searches were conducted based on references cited in these documents. Only four new documents were located by this procedure, resulting in a total of 46 documents.

Analysis of Literature. These 46 documents were obtained and classified into several categories, all of which were, at least in part, related to distance education in elementary and secondary schools: 5 reviews of research, 9 primary research studies, 22 position papers on distance education, 7 articles discussing various instructional materials or aides that are available for use in distance education programs, and 3 papers discussing solely the technical

components of distance education. After categorization, the documents were reviewed and analyzed to address the major study questions.

Findings from 14 of the documents in the first two categories (reviews and primary research) are discussed in this review because these are the studies which most directly address the three major questions stated above (although they provide very little convincing evidence to support their claims). Nine of these articles (the primary research pieces only; the review articles are not easily presented in a table format) are summarized in the table in the Appendix. References to the other 32 articles are available upon request; but because they provide even less evidence relevant to the questions guiding this inquiry, they are not presented here.

While the five reviews did not focus exclusively on distance education as it is used in elementary and secondary educational settings, issues relevant to these settings were addressed, so the following five review articles are included in the following analysis: Downing (1984), Feasley (1982), Hobbs (1985), Holmberg (1982), and Hudsen (1984).

In summary, because a comprehensive review of all the literature pertaining to implementation of distance education would be very costly, the focus of this review was limited only to elementary and secondary distance education. By replacing the manual review method of the original 503 documents with the considerably less expensive computer reduction method using multiple descriptors (as described above), it is possible some articles pertaining, at least in part, to elementary or secondary applications, have been overlooked. Thus, the reader should not necessarily consider this a comprehensive review of the literature pertaining to distance education in public schools. Rather this review is one methodical trek through a very large body of literature from which it will be clear what information is readily available with regard to the research questions stated above.

Question 1: What types of media are used?

Print media and technological media are not discussed discretely or, in some cases, not evaluated separately in the literature. Not only is it often difficult to separate conclusions

pertaining to higher education practices from conclusions about lower education practices, it is not always easy to separate out conclusions made exclusively about electronic media.

Print Media Versus Other Media. The reviews of distance education research conclude that the most common form of media used in distance education is print media (Feasley, 1982). However, this extensive use of print media in distance education is reflected more in higher education (correspondence course-like applications) than in public school education applications. Elementary and secondary distance education projects tend to use relatively more electronic media than do higher education applications. None of the literature reviewed reported that electronic media predominates print media in public school distance education; but this pattern can be assumed simply because correspondence courses are not customarily used with children. The importance in highlighting this basic difference between higher and lower distance education will become more apparent as the research findings and recommendations for future inquiries are identified.

Two-Way Radio. As might be expected, two-way radio is one of the more common forms of media used in public school distance education. Three of the primary studies reviewed (Perraton, 1981; Kitt, et. al., 1983; Alaska State Department of Education, 1982) used two-way radio for distance education. Each of these studies reported positive results; however, the conclusions which were drawn were quite general. Kitt et al. concluded that radio instruction used in conjunction with written correspondence is more effective than written correspondence alone, while Perraton's main conclusion was that radio instruction was "effective" because it reaches a large audience. Only the Alaska Department of Education reported academic gains. However, their report did not adequately present details about the size, statistical significance or meaning of these gains, reducing the confidence one can place in this finding.

Two-Way TV. While radio is one of the least expensive distance media and its effectiveness has yet to be substantiated convincingly, the questions about its effectiveness apply to more expensive media as well. Two-way television instruction has also been used and reported as being generally effective (Roth, 1980; Kelleher, 1983; Robertson, 1984) . Again,

researchers report that television is effective because it serves a large population and deals with specific, local needs rather than general needs. Kelleher reported that the teachers' abilities to communicate were enhanced by this medium, although the reason for this conclusion is not adequately described. Roth reported the use of two-way television in teacher in-service training and highlighted the time savings for teachers who did not have to travel to attend the in-service. Robertson concluded that the video portion is not necessarily needed, and, if it were eliminated (reducing the medium to two-way radio), in-service training at a distance would be more cost-efficient. Again, no evidence for this conclusion was given.

Combination of Media. As can be noted in Table 1, there are a variety of combinations of media, each of which has some intuitive appeal for various audiences. All of these warrant intense examination and comparison with other combinations of media. Computers, audio conferencing, slow-scan video teleconferencing, electronic blackboards, one-way and two-way radio , satellites, one-way and two-way television and traditional face-to-face instruction are all forms of instructional media which could be evaluatively compared.

However, only one of the studies conducted such a comparison. Kirman and Goldberg (1980) compared instruction via one-way television and telephone group conferencing with conventional face-to-face inservice instruction of teachers. They concluded that the one-way television and telephone group conferencing media combination was at least as "effective" as face-to-face instruction. The television/ telephone combination scored better on physical comfort and convenience ratings, although no significant group differences were found in teachers' subsequent capability to impart instruction.

Alternative Roles. While it is assumed that there is a great potential to transmit entire courses via long distance technology (Hobbs, 1985), applications of the technology in lower education are usually used to supplement and/or motivate rather than carry entire courses (Downing, 1984). Therefore, such evidence is lacking with regard to the actual roles electronic distance media can play in education and under what conditions it is most effective.

Comparisons of different roles (or intensities) of the use of distance education technologies in curricula are necessary.

Question 2: What is the Focus of the Instruction?

Distance education projects have addressed a variety of student populations in many subject areas; yet it is clear that more information about the content of the instruction along with comparisons between the types of students being served by distance education projects in public schools is needed in order to determine: 1) Which students are most effectively served by distance education; and 2) What content (and possibly even what instructional design) is most effectively transmitted via distance education technology.

Who is served? Some researchers report general usage of distance education technology for kindergarten through twelfth-graders (Alaska State Department of Education, 1982), for exceptional populations (Roth, 1980), and for inservice training of teachers (Roth, 1980; Perraton, 1981; Kirman & Goldberg, 1980).

However, none of the studies reviewed compared the effectiveness of instruction across different types of populations. Although, the Alaska State Department of Education provided distance education for students from kindergarten through twelfth-grade, they reported no effectiveness data with respect to differences due to variance in content nor due to different populations.

What Content and Instructional Design is Used? Barnhardt (1984), Hockley (1985) and the Alaska State Department of Education (1982) report using distance education to transmit a variety of curricula while others report using technology only for specific subject matters. For example, Kelleher (1983) reports using slow-scan video teleconferencing for reading instruction while Perraton (1981) used radio instruction for heath, nutrition, forestry and politics instruction. However, no studies offer insights into the comparative advantages and disadvantages of various course contents or other issues associated with the appropriate content for distance education programs. At best, the studies report what types of content were used in their studies, as though content were only a tangential variable of interest.

Koul (1984) warns against the assumption that a teacher brought up in conventional face-to-face instruction will au›matically be an effective distance educator. Thus, there is a need to evaluate the effectiveness of instructional design strategies, especially involving teachers who have not been trained as distance educators. However, little information is presented in any of these studies regarding the nature of the instructional designs used; and none of them have systematically compared the effectiveness of instruction using different instructional designs.

Question 3: What Judgements Have Been Made About Effectiveness?

While all the primary studies reviewed claim success (however vaguely defined), they present very little empirical evidence with respect to cognitive or skill gains. The Alaska State Department of Education reported gains in English, History, Mathematics and Developmental Reading, yet only implied that these were actually the areas in which the students were instructed via distance education. Detailed information about these gains, the length of time required to affect observable differences, as well as clear descriptions of the methods used in reaching conclusions is lacking. Kirman and Goldberg (1980) also reported gains associated with a distance education program, concluding that distance inservice training of teachers was at least as effective as face-to-face training based on subsequent performance of the students taught by the two groups of teachers.

It seems likely that some content areas are better suited to distance education than others, that some instructional designs and/or teaching techniques are more effective than others and, certainly that kindergarteners' experience with distance education is qualitatively different from twelfth-graders' experience. But, comparative questions of this type have not been the focus of distance education program developers' efforts.

By not addressing these questions, program developers seem to have given little regard to the appropriateness of the match between the media and content, media and instructional design or media and type of student and associated cognitive or skills gains. Instead they have defined program effectiveness in terms of how extensively a remote population is being

delivered new information or how well teachers and students enjoy distance education experiences.

Although many of the conclusions of the literature seem rather vague, several firm conclusions can be drawn. First, current programs are at various stages of implementation; most distance education programs are still in the initial stages of planning (at a committee or task force level). Second, those who have had experience beyond the initial stages have found that distance education courses have been accepted by state accreditation and have provided instruction in several curriculum areas where schools had previously been experiencing deficits (Downing, 1984). Third, all distance education programs which have reported initial findings indicate that services are being provided to students who would not otherwise have access to them. Fourth, in order to maximize benefits from available distance education technologies, developers are identifying other needs which can be met via the technology. The possibility of using distance education systems for teacher training is one such need currently being examined by some programs while several programs are actually using the technology for this purpose already (Downing, 1984).

Although most of the studies reviewed drew conclusions about the effectiveness of their programs which remain rather general, three sets of inquirers (Kelleher, 1983; Robertson, 1984; Kitt, et. al., 1983) attempted to address the issue of cost-effectiveness, which is the most specific criterion of effectiveness addressed by any of these studies. Unfortunately, it is difficult to determine what valid procedures, if any, they used to draw conclusions about the cost-effectiveness of their programs. Kitt et al. (1983) conclude that because satellite radio is so inexpensive, it is cost-effective. This conclusion is too general and fails to capitalize on the more sophisticated methods for conducting cost-effectiveness analyses. Similarly, Kelleher and Robertson do not provide adequate evidence leading to their claims of cost-effectiveness. Nevertheless, the attempts made by these studies set the stage for an evaluative component which most definitely must be included in future evaluations of distance education programs.

Implications for Future Inquiries

There are several implications deriving from this literature review which the State Office of Education and school personnel throughout Utah ought to consider.

Need for Evaluation

It is obvious that understanding the effects of distance education would be of value to program implementors as well as to the larger community of distance educators. However, the conclusions drawn about effectiveness are not well substantiated and, in fact, might be self-serving. Hudsen (1984) suggests that it is vital that old mistakes not be repeated by simply using distance education technology because it is a new and interesting means by which to educate. Rather it is important to carefully assess which technologies are most appropriate and effective enough to justify the additional costs involved.

Likewise, until the distance learning concept matures and the recommended components are integrated into programs using it, evaluation should be used to improve rather than test the idea. Thus, formative evaluations which begin with needs and input assessments as suggested by Stufflebeam, et. al. (1971) and help refine and maximize the best the objects of evaluation have to offer are imperative.

Hobbs (1985) identified one such critical component in his review of two of the most comprehensive distance education programs, one implemented by Oklahoma State University and one by the Utah Department of Education. He cites these two programs as exemplary because of their use of multiple media as the primary way to address problems in rural education, but offers a caution: To develop and implement systems involving multiple media (using satellite transmission of instructional material and advanced computer assisted instruction as well as in and out of the classroom interaction), it is necessary that individual schools collaborate with other institutions such as universities, state departments of education, other schools and private funding sources. The real effectiveness of such programs lies in the number of students served which depends on how well their institutions coordinate their distance education programs (Feasley, 1982; Hobbs, 1985).

Even in exemplary programs such as Oklahoma's and Utah's, cost-effectiveness of distance education is still limited due to the lack of collaboration and, therefore should not be assessed summatively until this and other weaknesses are identified through formative evaluations and improvements are made.

Evaluation Criteria

In order to conduct meaningful formative and summative evaluations, a set of criteria which is agreed upon by the various stakeholders in evaluations of distance education is necessary. Once collaborative and cooperative arrangements are in place it will be possible to assess more comprehensively, or summatively the effectiveness of distance education via electronic media.

What makes a distance education program effective is alluded to by most of these studies, although none have addressed the issue adequately. Some imply that effectiveness is the degree to which students in remote areas can be provided with instruction, or at least information of which they would otherwise be deprived (Barnhardt, 1984; Robertson, 1984; Hockley, 1985). Others imply that effectiveness is a reflection of how large an audience can be addressed through a single medium while still addressing local needs (Kelleher, 1983; Perraton, 1981). Some suggest that effectiveness in distance education is measured by how diverse the students' educational experience is (Barhardt, 1984), while others imply that cognitive or skill gains are important indicators of success (Alaska State Department of Education, 1982; Kirman and Goldberg, 1980). Roth (1980) suggests that another criterion is the degree to which teachers' loads are eased. Lastly, some believe that effectiveness should be assessed in terms of cost-effectiveness (Robertson, 1984; Kitt, et. al., 1983; Kelleher, 1983).

All of these criteria are important indicators of the effectivness of distance education, but none are sufficient alone. Future studies should combine these criteria and others identified by relevant audiences of the evaluation to establish a comprehensive set of standards against which distance education programs can be judged.

Summary

The intent of this review was to address three main questions pertaining to distance education in elementary and secondary schools. The first question was, What media are used? While literature pertaining to distance education in higher education indicate that print is the predominant form of media used in distance education, this is not the case in lower level distance education. Rather, a wide variety of media and combinations of media are being used; computers, audio conferencing, slow-scan video teleconferencing, electronic blackboards, one-way and two-way radio , satellites, one-way and two-way television. Although all studies report the use of these media in distance education, very little information is provided about actual implementation of these media. Consequently, it is difficult to determine exactly what is involved in the use of the various media.

The second question addressed by this review was, What is the focus of the instruction (that is, who is served and what content and instructional designs are used)? The examination of literature pertaining to the origins of distance education indicated that distance education students in higher education are adults who are furthering their education while continuing to work. The literature indicates that children from kindergarten through twelfth-grade are also enrolled in distance education. Unfortunately, no other information is given with respect to the characteristics of these children.

It is possible that distance education students, because of the circumstances which lead to the availability of distance education, are different than other students enrolled in conventional elementary and secondary school. It is also possible that within the population of distance education students, there are some who are more successful, or who like it more than others. Understanding these characteristics is instrumental in planning future distance education endeavors at the elementary and secondary levels.

Similarly, little data is available regarding what instructional content is being used or could be best used in distance education at the elementary and secondary levels. Nor is it clear which instructional design approaches are most appropriate in the transmission of the content.

The third question was, what judgements have been made about effectiveness? In light of the first question, there is relatively little evidence of which media or combinations of media are being used most effectively in distance education at elementary and secondary levels. While several studies have examined cognitive or skills gains, there is little empirical evidence which lead to conclusions about effectiveness. Further, there is no data indicating what types of students experience the most success in distance education at the elementary or secondary levels. Cost-effectiveness is reported by several researchers, although it is questionable whether the positive conclusions drawn were justified. Consequently future inquiries were suggested in light of the deficits of information reported above.

Even though little data is being collected on the efficacy of distance education via electronic media, distance education is being used rather widely to address rural education needs, teacher shortages and general lack of resources (Hudsen, 1984). For those engaged in planning or implementing distance education programs, a variety of information is available which can assist in program development, teacher training in distance education and other practical assistance pertaining to implementation (see ERIC, monographs, or contact authors of this review for more information on these topics). Of key importance is careful management; designing and planning of distance education programs which can be done by drawing on the experience of others (Hudsen, 1984).

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Appendix

Summary Table

Citation	Population Served	Technology and Content	Conclusions	Implications
Alaska State Dept. of Education (1982)	Kindergarten through twelvth-grade in 25 rural villages in Alaska	One-way and two-way audio via the ATS-I satellite was used as a health training aid for kindergarten through fifth-graders. System was also used for administrator, teacher and classroom exchanges.	Evaluation results indicated gains due to the telelearning program. Further students preferred the program over regular teaching systems. Teachers favored the satellite program.	An overall communication plan should be developed for Alaska.
Barnhardt, C. (1984)	Rural elementary school in Alaska. It is a "Bush Community" composed of villages Aleuts, Eskimos and Indians.	Computers as communication tools via electronic networking. Audio conferencing for inter-village planning. Content was special education, math drills, and science research projects. Students interacted with students in California; teachers with teachers and administrators with administrators.	Helps to enrich diversity in the schooling process. Provides many resources previously not available. Can offer a wider variety of coursework. Access to a large educational data base and to a wide variety of resource people. Teachers can exchange information and take university courses to further their training. Computers can send and receive information faster than by telephone and are less expensive than audio-conferencing.	Potential to allow students and teachers in small rural school to become more independent and self sufficient. Telelearning is a useful tool for decentralization.
Hockley, R.F. (1985)	Students who lived in isolated homesteads and camps scattered over an area of approx. 650,000 miles in the southern half of the Northern Territory of Australia.	Two-way radio was used in addition to written correspondence for a variety of contents including mathematics, language, social studies and current events.	The results indicated that information was made available to students who otherwise would have been deprived.	

Citation	Population Served	Technology and Content	Conclusions	Implications
Kelleher, K. (1983)	Elementary and Secondary school in South Bend, Indiana.	Slow-Scan Video teleconferencing for teaching second and third-graders reading (emphasis on consonant and vowel discrimination).	Slow-scan video conferencing was effective because it was able to serve specific, local needs without having to appeal to a large audience. It was also found that the teachers' abilities to communicate were enhanced. Evidence was also found that slow-scan video conferencing for this purpose was cost-effective.	
Kirman, J.M.& Goldberg, J. (1980)	Compared fourth, fifth and sixth-grade teachers two types of inservice training in Edmonton and Sherwood Park, Alberta, Canada.	Edmonton teachers received training through traditional face-to-face training while Sherwood Park teachers received traing via one-way television and telephone group conferencing.	Results indicated that the one-way television mode is at least as effective as a face-to-face mode of delivery. Teachers, however, prefer face-to-face delivery. The one-way TV mode was found to be spurious on physical comfort and convenience ratings, but no significant difference was found in capabilities due to the instruction.	Future questions were raised: What type of content best lends itself to this mode of instruction? Would students instructed only by television lecture perform as well as students using TV-telephone group instruction? How would students perform using this mode of instruction on an individual basis rather than being in a group?
Kitt, J. & Others (1983)	Isolated students in Northwest Queensland, Australia	Two-way radio, via satellite was used to support home tutors in the interpretation of correspondence school papers, development and enrichment of oral communication, motivation of children working form correspondence school papers, identification of learning and speech difficulties and a provision of an avenue for socialization through daily contact periods.	Results indicated that satellite radio is inexpensive and cost-effective. School of the air and correspondence is more effective than paper correspondence alone.	There is a possibility for using this technology as a means for uniformly strengthening educational programs on a regional level.

Citation	Population Served	Technology and Content	Conclusions	Implications
Perraton, H. (1981)	School teachers in Tanzania and Botswana, Africa	Radio was used for teacher training in health, nutrition, forestry and politics.	Results identified the advantages of radio in education; it reaches a large audience and is the predominant medium in the third world.	
Robertson, W. D. (1984)	Remote areas of British Columbia where elementary, middle, secondary and higher educatio needs were addressed.	Teleconferencing and audio/video teleconferencing (full scan and slow scan) were used both in a two-way and one-way fashion. Telephones were also used in conjuction with video, electronic blackboards, computer graphics, radio and satellites. Content was not mentioned.	Effective techniques for reaching remote areas. It was also found that the techniques were cost-efficient, especially when video was not incorporated. Additionally, it was concluded that video was not a necessary component in distance learning.	These distance learning techniques help reduce teachers' loads and reduce stress. Further, children in remote areas are provided educational opportunities they would otherwise be deprived of.
Roth, E.B. (1980)	Teachers in Williamsburg, Newport News and King William Counties, Virginia were provided inservice training via distance learning technologies.	Two-way instructional television was used for inservice training for gifted program and another special education program.	Results indicated savings in energy and teacher's time.	A variety of uses of the technology are evident and the state officials are interested in exploring possibilities for further development including inservice training throughout the state.